CLAIMS

What is claimed is:

1. A fuel processing system for a fuel cell comprising:

a fuel processor having a fuel inlet receiving a fuel and an outlet discharging a reformate containing hydrogen, said fuel processor operable to break down said fuel to form said reformate;

a fuel metering device providing fluid communication between a fuel supply and said fuel inlet to selectively input said fuel to said fuel processor;

a valve in fluid communication with said outlet; and

a controller modulating said valve to control a flow rate of said reformate discharged from said fuel processor.

2. The fuel processing system of claim 1 further comprising a water metering device providing fluid communication between a water supply and a water inlet of said fuel processor to selective input said water to said fuel processor.

3. The fuel processing system of claim 2 wherein said fuel processor is a steam reforming reactor.

4. The fuel processing system of claim 2 wherein said fuel processor includes a partial oxidation reformer and a water gas shift reactor located between said partial oxidation reformer and said valve.

5. The fuel processing system of claim 2 said fuel processor includes an auto thermal reformer and a water gas shift reactor located between said auto thermal reformer and said valve.

6. The fuel processing system of claim 2 wherein said fuel processor includes an auto thermal reformer and a steam reforming reactor.

7. The fuel processing system of claim 6 wherein said auto thermal reformer and said steam reforming reactor are coupled in parallel between said fuel inlet and said control valve.

8. The fuel processing system of claim 1 wherein said fuel processor acts as a storage buffer when said valve is at least partially closed.

9. The fuel processing system of claim 1 further comprising a flow rate sensor in fluid communication with an air inlet of said fuel processor for generating a control signal as a function of a flow rate of said air provided to said fuel processor, said controller using said control signal to modulate said valve.

10. The fuel processor of claim 9 further comprising an air compressor in fluid communication with said air inlet, said controller using said control signal to modulate said compressor.

11. The fuel processing system of claim 1 further comprising:

a fuel cell stack having an anode inlet in fluid communication with said control valve, said fuel cell stack operable to generate electrical energy and an anode exhaust from said reformate; and

a stack sensor for generating a control signal based on at least one of a stack voltage signal and a stack cell voltage variation signal, said controller using said control signal to modulate said valve.

12. The fuel processing system of claim 1 further comprising a pressure differential sensor connected to an inlet and an outlet of said valve for generating a control signal based on a pressure differential across said valve, said controller using said control signal to modulate said valve.

13. A control system for a fuel processor of a fuel cell stack, comprising:

a water metering device that controls water provided to said fuel processor;

a fuel metering device that controls fuel provided to said fuel processor;

an air flow rate sensor that generates an air flow rate signal based on air flowing to said fuel processor;

a valve located between said fuel processor and said fuel cell stack; and

a controller that controls said valve, said water metering device and said fuel metering device based on said air flow rate signal.

14. The control system of claim 13 wherein said fuel processor includes a steam reforming reactor.

15. The control system of claim 13 wherein said fuel processor includes a partial oxidation reformer and a water gas shift reactor located between said partial oxidation reformer and said valve.

16. The control system of claim 13 wherein said fuel processor includes an auto thermal reformer and a water gas shift reactor located between said auto thermal reformer and said valve.

17. The control system of claim 13 wherein said fuel processor includes an auto thermal reformer and a steam reforming reactor.

18. The control system of claim 17 wherein said auto thermal reformer and said steam reforming reactor are coupled in parallel between a fuel supply and a water gas shift reactor.

19. The control system of claim 13 wherein said fuel processor acts as a storage buffer when said valve is partially or completely closed.

20. A fuel processor for a fuel cell stack, comprising:

a water metering device that controls water provided to said fuel processor;

a fuel metering device that controls fuel provided to said fuel processor;

a stack sensor that generates one of a stack voltage signal and a stack cell voltage variation signal;

a valve located between said fuel processor and said fuel cell stack; and

a controller that controls said valve, said water metering device and said fuel metering device based on said one of said stack voltage signal and said stack cell voltage variation signal.

21. The control system of claim 20 wherein said fuel processor is a steam reforming reactor.

22. The control system of claim 20 wherein said fuel processor includes a partial oxidation reformer and a water gas shift reactor located between said partial oxidation reformer and said valve.

23. The control system of claim 20 said fuel processor includes an auto thermal reformer and a water gas shift reactor located between said auto thermal reformer and said valve.

24. The control system of claim 20 wherein said fuel processor acts as a storage buffer when said valve is partially or completely closed.

25. A fuel processor for a fuel cell stack, comprising:

a water metering device that controls water provided to said fuel processor;

a fuel metering device that controls fuel provided to said fuel processor;

a valve located between said fuel processor and said fuel cell stack;

a pressure differential sensor connected to an inlet and an outlet of said valve that generates a pressure differential signal; and

a controller that controls said valve, said water metering device and said fuel metering device based said pressure differential signal.

26. The control system of claim 25 wherein said fuel processor is a steam reforming reactor.

27. The control system of claim 25 wherein said fuel processor includes a partial oxidation reformer and a water gas shift reactor located between said partial oxidation reformer and said valve.

28. The control system of claim 25 said fuel processor includes an auto thermal reformer and a water gas shift reactor located between said auto thermal reformer and said valve.

29. The control system of claim 25 wherein said fuel processor acts as a storage buffer when said valve is partially or completely closed.

30. A fuel processor for a fuel cell stack, comprising:

a water metering device that controls water provided to said fuel processor;

a fuel metering device that controls fuel provided to said fuel processor;

a valve located between said fuel processor and said fuel cell stack;

a flow rate sensor connected between said valve and said fuel cell stack for providing a stack flow rate signal; and

a controller that controls said valve, said water metering device and said fuel metering device based said stack flow rate signal.

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31. The control system of claim 30 wherein said fuel processor is a steam reforming reactor.

32. The control system of claim 30 wherein said fuel processor includes a partial oxidation reformer and a water gas shift reactor located between said partial oxidation reformer and said valve.

33. The control system of claim 30 said fuel processor includes an auto thermal reformer and a water gas shift reactor located between said auto thermal reformer and said valve.

34. The control system of claim 30 wherein said fuel processor acts as a storage buffer when said valve is partially or completely closed.

35. A method of controlling a fuel processor for a fuel cell stack, comprising:

providing a fuel cell stack and a fuel processor;

metering water provided to said fuel processor;

metering fuel provided to said fuel processor;

sensing a flow rate of air to said fuel processor;

providing a valve between said fuel processor and said fuel cell stack; and

controlling said valve, said water metering device and said fuel metering device based on said air flow rate.

36. The method of claim 35 wherein said fuel processor includes an auto thermal reformer and a water gas shift reactor.

37. The method of claim 35 wherein said fuel processor includes a partial oxidation reformer and a water gas shift reactor.

38. The method of claim 35 wherein said fuel processor includes a steam reforming reactor.

39. The method of claim 35 wherein said fuel processor acts as a storage buffer when said valve is partially or completely closed.

40. A method of controlling a fuel processor for a fuel cell stack, comprising:

providing a fuel cell stack and a fuel processor;

metering water provided to said fuel processor;

metering fuel provided to said fuel processor;

sensing at least one of stack voltage and stack cell voltage variation;

providing a valve between said fuel processor and said fuel cell stack; and

controlling said valve, said water metering device and said fuel metering device based on said at least one of said stack voltage and said stack cell voltage variation.

41. The method of claim 40 wherein said fuel processor includes an auto thermal reformer and a water gas shift reactor.

42. The method of claim 40 wherein said fuel processor includes a partial oxidation reformer and a water gas shift reactor.

43. The method of claim 40 wherein said fuel processor includes a steam reforming reactor.

44. The method of claim 40 wherein said fuel processor acts as a storage buffer when said valve is partially or completely closed.

45. A method of controlling a fuel processor for a fuel cell stack, comprising:

providing a fuel cell stack and a fuel processor;

metering water provided to said fuel processor;

metering fuel provided to said fuel processor;

providing a valve between said fuel processor and said fuel cell stack;

monitoring a pressure differential between an inlet and an outlet of said valve; and

controlling said valve, said water metering device and said fuel metering device based on said pressure differential.

46. The method of claim 45 wherein said fuel processor includes an auto thermal reformer and a water gas shift reactor.

47. The method of claim 45 wherein said fuel processor includes a partial oxidation reformer and a water gas shift reactor.

48. The method of claim 45 wherein said fuel processor includes a steam reforming reactor.

49. The method of claim 45 wherein said fuel processor acts as a storage buffer when said valve is partially or completely closed.

50. A method of controlling a fuel processor for a fuel cell stack, comprising:

providing a fuel cell stack and a fuel processor;

metering water provided to said fuel processor;

metering fuel provided to said fuel processor;

providing a valve between said fuel processor and said fuel cell stack;

monitoring gas flow rate between an outlet of said valve and said fuel cell stack; and

controlling said valve, said water metering device and said fuel metering device based on said gas flow rate.

51. The method of claim 50 wherein said fuel processor includes an auto thermal reformer and a water gas shift reactor.

52. The method of claim 50 wherein said fuel processor includes a partial oxidation reformer and a water gas shift reactor.

53. The method of claim 50 wherein said fuel processor includes a steam reforming reactor.

54. The method of claim 50 wherein said fuel processor acts as a storage buffer when said valve is partially or completely closed.